Journal of Cardiology Cases 7 (2013) e142–e144

Contents lists available at www.sciencedirect.com

Journal of Cardiology Cases

journal homepage: www.elsevier.com/locate/jccase

Case Report

Impella 2.5 in a patient with left main coronary artery occlusion

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ARTICLE INFO

Article history:
Received 25 July 2012
Received in revised form
30 November 2012
Accepted 3 January 2013

Keywords:
Impella
Assist device
Left main artery occlusion
Cardiogenic shock
Primary percutaneous coronary intervention

ABSTRACT

Short-term assist devices have been indicated in many clinical settings mostly as a bridge to the next step. In this article, we report a case of cardiogenic shock due to acute occlusion of left main coronary artery who was scheduled to be transferred from Iran to Germany for the next treatment (permanent assist device implantation). Impella 2.5 (Abiomed Inc., Danvers, MA, USA), a short-term assist device, made the long distance journey possible.

<Learning objective: Managing of severe cardiogenic shock by early revascularization and prompt installation of mechanical circulatory support in peripheral hospital as bridge to decision and successful long-distance transfer on mechanical circulatory support.>

Case report

A 54-year-old man, 187 cm and 92 kg, came to the emergency room with severe frequent resting chest pain and deteriorating hemodynamic status. The medical history was remarkable for an old myocardial infarction, a percutaneous angioplasty and stenting on left anterior descending (LAD) artery 10 years prior to admission and a history of active heavy smoking. Electrocardiography showed sinus tachycardia and ST-segment elevation in precordial leads.

Transthoracic echocardiography revealed severe left ventricular systolic dysfunction, the left ventricular ejection fraction (LVEF) was 5–10%. Left ventricular end-diastolic diameter was mildly increased (62 mm) and the interventricular septal and posterior wall thickness were likely preserved (10 and 8 mm, respectively). There was a left ventricular apical aneurysm. Left atrial area was 19 cm^2 and right ventricular end-diastolic diameter was 34 mm. There was a mild to moderate tricuspid regurgitation with Doppler measured peak-systolic jet velocity of 3.8 m/s.

The patient lost consciousness while being examined in the emergency room. On arrival the blood pressure could be measured around 75 mmHg but the pulses were rapidly lost to palpation along with developing a cold clammy skin and unconsciousness. He then was promptly transferred to the catheterization unit and emergent coronary angiography was performed. His heart rate was 110 bpm on arrival and 140 bpm on starting angiography. There was a patent dominant right coronary artery (RCA) and a totally occluded left main stem in distal portion (Figs. 1 and 2). We decided to perform complete revascularization of left coronary system in catheterization unit as a salvage strategy. Intra-aortic balloon pump (IABP) was implanted due to severe hypotension and refractory ventricular arrhythmia.

After wiring of LAD and left circumflex artery (LCX), balloon angioplasty and stenting of distal left main artery, proximal LAD, and LCX was performed with three bare-metal stents ensuring a good angiographic result and thrombolysis in myocardial infarction (TIMI) grade 3 flow in all coronary arteries (Fig. 3). Right heart catheterization showed pulmonary arterial pressure (PAP) of 55/35 mmHg with a wedge pressure (PCWP) of 32 mmHg and cardiac index (CI) of 1.9 l/min/m^2.

Mechanical ventilation, IABP support and aggressive medical therapy failed to stabilize the hemodynamic status over the following 48 h. The patient was again transferred to the catheterization laboratory and upon confirmation of patency of the coronary arteries by selective angiography, we decided to implant the Impella LP®2.5 (Abiomed Inc., Danvers, MA, USA) for better hemodynamic support (Fig. 4). PAP, PCWP, and CI were 60/35 mmHg,

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1878-5409/$ – see front matter © 2013 Published by Elsevier Ltd on behalf of Japanese College of Cardiology.
http://dx.doi.org/10.1016/j.jccase.2013.01.002

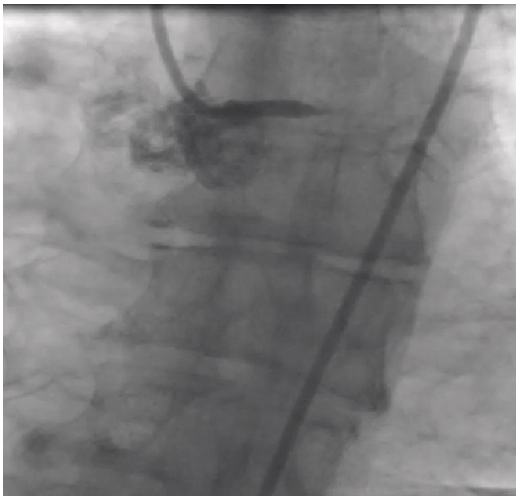

Fig. 1. Coronary angiography on arrival showed patent dominant right coronary artery.

Fig. 2. Coronary angiography on arrival showed a totally occluded left main stem in the distal portion.

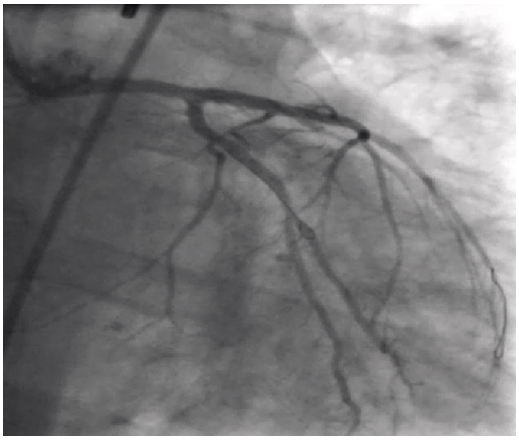

Fig. 3. Final primary angioplasty result showing thrombolysis in myocardial infarction grade 3 flow in left coronary arteries.

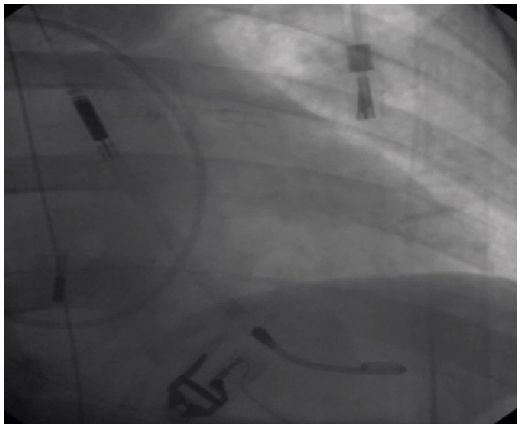

Fig. 4. Impella LP®2.5 implantation for hemodynamic support.

40 mmHg, and 1.6 l/min/m^2 before implantation and improved to 45/25 mmHg, 28 mmHg, and 2.1 l/min/m^2 after implantation.

Over the following days, the patient's condition became dramatically better with stabilization of blood pressure and disappearance of arrhythmia; echocardiography revealed improvement in LVEF (up to 20–25%) with a slight decrease in right ventricular end-diastolic size (32 mm) and a tricuspid regurgitation peak-systolic velocity of 3.4 m/s; other measures remained the same.

The patient's case was discussed with the expert team at Berlin Heart Institute and it was planned that he be transferred to Berlin for the next therapeutic step. The flight from Tehran to Berlin on a Challenger 600 (Rega Swiss Ambulance) was accomplished uneventfully with similar numbers and doses of inotropes. The non-stop flight was performed at regular cruise speed at an altitude of 10,000 m. The pressure drop in the cabin (equivalent to 2000 m above sea level) was well tolerated and required a slight increase in the vasopressor dose. During the transport, the ventilated patient remained awake and informed about the situation, mean blood pressure was maintained around 80 mmHg, heart rate around 100 bpm and hematocrit around 30%, and the urine output was over 75 cm^3/h. Heparin infusion maintained activated partial thromboplastin time between 50 and 60 s during flight. After arrival at the Berlin Heart Institute, he was admitted to an intensive care unit on Impella support and heparin and was scheduled for implantation of a long-term left ventricular support device, but unfortunately upon developing a massive intracranial hemorrhage two days later, the patient died.

Discussion

Cardiogenic shock constitutes a complication of acute coronary syndromes, occurring predominantly after an acute myocardial infarction with ST elevation, and is associated with high mortality rates, ranging from 56% to 74% in several reports [1–3]. Left ventricular breakdown in patients with post-MI cardiogenic shock is usually due to large areas of ischemia in consequence to extensive coronary disease. Timely and reasonable revascularization policy along with sufficient hemodynamic support probably by ventricular assist devices may lead to a better prognosis in these patients.

The IABP is the most widely used hemodynamic support device. It works through counterpulsation, augmenting the diastolic pressure and consequently the coronary perfusion pressure and reducing the afterload, leading to an increase in cardiac output. The most important limitations of IABP are the inability to provide inadequate support in patients with severely compromised LV function, as well as in patients with very rapid and irregular heart rates. In the face of these limitations, new intravascular devices have been developed, extending the concept of LV assistance from

the surgical arena to the catheterization laboratory, and thus allowing the expansion of mechanical circulatory support indications. These devices have been evaluated in patients with hemodynamic collapse due to cardiogenic shock, acute myocarditis, transplant rejection, or postcardiotomy [4,5].

The TandemHeart (CardiacAssist, Pittsburgh, PA, USA), a percutaneous assist device, has been used successfully for temporary support after cardiotomy and is said to be helpful to perform complex procedures (balloon aortic valvuloplasty and angioplasty) in unstable patients. The main complication has been pericardial bleeding [10–12].

The Impella Recover LP 2.5 is a versatile and small device which can be easily implanted via percutaneous approach without any major complication (no need for septostomy as opposed to TandemHeart). The Impella LP 2.5 is capable of pumping blood up to 2.5 l/min [6–9]. In this case, possibly the first human case description, the Impella was used as a short-term hemodynamic support tool for a patient in cardiogenic shock that enabled safe long-distance transport. Therefore, the Impella might be used as a versatile, reliable, and safe support tool in a hub center organization in order to transfer eligible patients from small cardiologic centers/departments to large centers with possibilities for transplantation and long-term assist device implantation.

We assume the elevated blood pressure during waking up state as well as over-anticoagulation to be plausible causes for our patient's hemorrhage. Lower anticoagulation levels with Impella might be reasonable and discussable, as has been addressed with other axial flow assist devices [13]. Changes in cabin pressure during flight are less of a possibility to induce such a hemorrhage, even under intense anticoagulation.

References

[1] Goldberg RJ, Gore JM, Thompson CA, Gurwitz JH. Recent magnitude of and temporal trends (1994–1997) in the incidence and hospital death rates of cardiogenic shock complicating acute myocardial infarction; the second national registry of myocardial infarction. Am Heart J 2001;141:65–72.

[2] Holmes Jr DR, Bates ER, Kleiman NS, Sadowski Z, Horgan JH, Morris DC, Califf RM, Berger PB, Topol EJ. Contemporary reperfusion therapy for cardiogenic shock: the GUSTO-I trial experience, The GUSTO-I Investigators. Global utilization of streptokinase and tissue plasminogen activator for occluded coronary arteries. J Am Coll Cardiol 1995;26:668–74.

[3] Goldberg RJ, Samad NA, Yarzebski J, Gurwitz J, Bigelow C, Gore JM. Temporal trends in cardiogenic shock complicating acute myocardial infarction. N Engl J Med 1999;340:1162–8.

[4] Siegenthaler MP, Brehm K, Strecker T, Hanke T, Nötzold A, Olschewski M, Weyand M, Sievers H, Beyersdorf F. The Impella Recover microaxial left ventricular assist device reduces mortality for postcardiotomy failure; a three-center experience. J Thorac Cardiovasc Surg 2004;127:812–22.

[5] Jurmann MJ, Siniawski H, Erb M, Drews T, Hetzer R. Initial experience with miniature axial flow ventricular assist devices for postcardiotomy heart failure. Ann Thorac Surg 2004;77:1642–7.

[6] Valgimigli M, Steendijk P, Sianos G, Onderwater E, Serruys PW. Left ventricular unloading and concomitant total cardiac output increase by the use of percutaneous Impella Recover LP 2.5 assist device during high risk coronary intervention. Catheter Cardiovasc Interv 2005;65:263–7.

[7] Meyns B, Stolinski J, Leunens G, Verbeken E, Flameng W. Left ventricular support by catheter-mounted axial flow pump reduces infarct size. J Am Coll Cardiol 2003;41:1087–95.

[8] Hochman JS. Cardiogenic shock complicating acute myocardial infarction: expanding the paradigm. Circulation 2003;107:2998–3002.

[9] Sjauw KD, Remmelink M, Baan J, Lam K, Engstorm AE, van der Schaaf RJ, Vis MM, Koch KT. Left ventricular unloading in acute ST-segment elevation myocardial infarction patient is safe and feasible and provides acute and sustained left ventricular recovery. J Am Coll Cardiol 2008;51:1044–6.

[10] Pitsis AA, Visouli AN, Burkhoff D, Dardas P, Mezilis N, Bougioukas G, Filippatos G. Feasibility study of a temporary percutaneous left ventricular assist device in cardiac surgery. Ann Thorac Surg 2007;84:1993–9.

[11] Rajdev S, Irani A, Sharma S, Kini A. Clinical utility of TandemHeart for high-risk tandem procedures: percutaneous balloon aortic valvuloplasty followed by complex PCI. J Invasive Cardiol 2007;19:E346–9.

[12] Rajdev S, Benza R, Misra V. Use of TandemHeart as a temporary hemodynamic support option for severe pulmonary artery hypertension complicated by cardiogenic shock. J Invasive Cardiol 2007;19:E226–9.

[13] Jurmann MJ, Siniawski H, Erb M, Drews T, Hetzer R. Initial experience with miniature axial flow ventricular assist device for postcardiotomy heart failure. Ann Thorac Surg 2004;77:1642–7.